

## **MANNING CANYON TAILINGS REMOVAL ACTION**

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### **ABSTRACT**

The Salt Lake Field Office of the Bureau of Land Management proposed a Special Management Recreation Area (SMRA) in an area referred to as Five Mile Pass. An abandoned mine land inventory was conducted jointly with the Bureau of Land Management Utah State Office and the State Abandoned Mine Reclamation Program. As a result of this inventory effort, the Utah State Office recommended that additional characterization of the Manning Canyon tailings was necessary in order to determine how to appropriately reclaim the tailings on BLM administered lands.

The Manning Canyon tailings are located in Manning Canyon near Fairfield, Utah on property administered by the Bureau of Land Management (BLM) and on land privately owned. The tailings are associated with the historic Manning Canyon gold mill that operated during the early 1900s. Approximately 720,000 cubic yards of arsenic tailings in four historic tailings ponds have migrated over several hundred acres. Nearly half of the tailings volume has migrated through dam breaches and have moved down gradient to the town of Fairfield, prompting an EPA emergency yard soil removal.

Concentrations of arsenic in the tailings range from 2000-10,000 ppm. There is no groundwater within 100 feet of ground surface. The site is heavily used by off-road vehicles and other recreational purposes. Beginning in 1999, BLM performed CERCLA site characterization studies and in 2001, selected a remedy to consolidate the tailings into an on-site repository. The Bureau of Reclamation prepared the design package featuring a capillary barrier engineered cap for the repository. Funding for the \$8 million cleanup project has been obtained from the Department of Interior's Central Hazardous Materials Fund. Construction is scheduled to begin this summer.

### **SITE DESCRIPTION**

The Manning Canyon Mill Site (Site) is an abandoned gold milling facility located in the Oquirrh Mountains of Utah County, Utah, approximately 40 miles south of Salt Lake City. A gravel road that is maintained by the county accesses the Site. This road intersects State Highway 73 about two miles south of Cedar Fort, Utah.

Approximately 720,200 cubic yards of tailings and waste rock have been deposited within the Site. This material was generated by the Manning Mill that processed ore at the site from 1890 until 1937. The waste material from the mill was disposed of in tailings ponds that have breached in the past allowing the tailings to wash downstream. This material is highly susceptible to wind and water erosion and transport downstream by surface water flows in the intermittent drainage channels that drain Manning Canyon. The

tailings and waste rock contain elevated levels of arsenic, mercury, and lead that pose a threat to human health and the environment within and downstream of the Site.

An Engineering Evaluation and Cost Analysis (EE/CA) was prepared by BLM (BLM, 2000). The Executive Summary of the EE/CA is an attachment to this Action Memorandum. The EE/CA defines the nature and extent of contamination, assesses the human health and environmental risks posed by the contaminants of concern, identifies response action objectives, treatment technologies, and removal action alternatives, and compares the alternatives on the basis of effectiveness, implementability, and estimated cost. The EE/CA provides a basis for funding determinations and planning to conduct a non-time-critical response action under CERCLA. This action is considered necessary due to relatively high concentrations of arsenic, mercury, and lead at the Site and the potential for these hazardous substances to affect humans exposed to the Site and the environment surrounding the source areas.

The Site encompasses an area of approximately 1,470 acres or 2.30 square miles. There are six (6) defined tailings areas, which cover approximately 66 acres. Of this total approximately 21 acres are on private land, and 44 acres are on public land administered by the Department of the Interior, Bureau of Land Management (BLM). Based on field measurements of the aerial extent and approximate depth of tailings and waste rock on the Site, approximately 305,600 cubic yards of waste material are deposited on private land, and 414,600 cubic yards of waste material are deposited on public land. On a volume basis, 42 percent of the waste material is on private land, and 58 percent of the waste material is on public land. A map showing the features at the Site is provided in Figure 1.

Manning Canyon drains an area of over eight square miles through several ephemeral drainage channels that transect the valley. Drainage from the Site is usually associated with spring snow melt and rain storms. There are two main drainage channels that run parallel and southeasterly to drain Manning Canyon. The tailings and waste rock deposits are generally situated on the floor of the canyon in or near the main drainage channels. These waste deposits are essentially devoid of vegetation. Vegetation surrounding the waste deposits includes pinyon pine, juniper, sage brush, and Indian rice grass.

In addition to the previous industrial uses, over the past 30 years the Site has supported off-road vehicle use and other outdoor recreation. The BLM Salt Lake City Field Office has estimated that over 1,000 persons use the site for recreational purposes per year. The area is undergoing rapid growth and use is increasing substantially each year. Because of the large size of the site, signs and fences have been ineffective in reducing use.

Manning Canyon is located in the Mercur Mining District, adjacent to the West Mercur and Fivemile Pass Mining Districts. The Mercur District was first organized in 1870 as the Floyd Mining District when silver lode discoveries were made. As time went on, gold became the primary commodity produced, causing a production or mining boom from 1898 through 1912. Mines located in the southern Oquirrh Mountains have also produced precious and base metals and clay.

In 1890, the Manning Mill was built to treat ore from the Mercur vein by pan amalgamation. The Manning Mill was remodeled in the summer of 1890 to process ore by the cyanide process. From 1890 to 1900 the crude ores mined at Mercur, Utah, 5 miles northwest of Manning, were transported by team and wagon and later by a privately owned railroad, and were leached in tanks by percolation with solutions of potassium cyanide. The mill expanded to 50 tons daily, then to 100 tons in 1893, to 200 tons in 1896, and

then to 500 tons. Following construction of the Golden Gate Mill in 1898, the Manning Mill ceased treating Mercur ores and was used to process tailings. In 1933, a second mill was constructed at the Manning Mill Site to re-treat the estimated 455,000 tons of tailings in large dumps. From September 1934 to July 1936, an average of 536 tons of material (both tailings and crude ore) were treated per day. In addition to re-treating the tailings dumps left by the operations of the prior Manning Mill, the second Manning Mill operated as a custom plant to treat crude ores from Mercur and some ores from outside the Camp Floyd Mining District. After this second mill completed re-treatment of all the Manning "dumps," the mill was relocated in 1937 to Mercur.

Much of the private land in the surrounding areas includes patented mining claims from the late 1800s and early 1900s. Clay mining on these private lands remains active today. Private land located to the south is used for agricultural purposes, including wheat fields approximately 1.8 miles southeast of the Site. The small town of Fairfield is located 3.5 miles southeast of the Site. The Site has a history of recreational use. Purchased by its current owners in the 1950s, the private portion of the Site hosted national motocross events in the 1970s. Since then, off-road vehicle users and other recreational users have frequented the Site. March through September are high use months, usually receiving six to 10 vehicles per day with multiple passengers. The winter months receive less visitors. The BLM Salt Lake Field Office estimates an annual visitation of approximately 1,050 by tourists and locals. All terrain vehicles (ATVs), bicyclists, campers, and youths shooting paintball guns have been observed on the tailings deposits within the Site.

## **REMOVAL SITE EVALUATION**

A site investigation was conducted in September 1999 to collect data and make observations necessary to develop the EE/CA. The findings of this investigation are summarized in Section 2 of the EE/CA. The tailings piles were sampled extensively on the surface and using soil borings to characterize the metals concentrations and depth of the tailings. Arsenic averages 7,107 ppm in Tailings Area 1, 4,866 ppm in Tailings area 2, 7,436 ppm in Tailings Area 3, 5,580 ppm in Tailings Area 5, and 3,601 ppm in Tailings Area 6. The tailings are unsaturated, and alkaline in their chemistry. Because of the large size of the site, electrical resistivity geophysics was also used to characterize depth of tailings. This effort was to determine the volume and location of tailings that need to be moved from the floodplain. Monitoring wells were installed upgradient and downgradient of the site. No water was encountered at more than 150' below ground surface downgradient of the site. Sampling of sediment in the eastern and western drainages verified the migration of tailings of arsenic from the Site to the railroad right-of-way. Other work performed included a phase 1 cultural clearance and studying the drainages for determining the 100 year flood event and flood plain, and to propose reconstruction of the channels after removal.

## **RISK ASSESSMENT**

Arsenic, lead and mercury are CERCLA hazardous substances. The presence of these hazardous substances within the tailings ponds, the main drainage channels, and downstream of the Site constitutes a release and a substantial threat of release of hazardous substances into the environment as defined by

CERCLA. A streamlined risk assessment was conducted and is provided in the EE/CA. This risk assessment identified arsenic as the primary chemical of concern at the Site. Maximum concentrations of arsenic in tailings exceed the risk management criteria (RMC) for a recreational camper exposure scenario by 76-fold, and would be rated a high-risk according to BLM guidance (Ford, 1996).

Lead and mercury, the two other chemicals of concern at the Site, were found in maximum concentrations that did not exceed human health RMCs, and only slightly exceeded the wildlife RMC. It is expected that lead and mercury exceedances of the wildlife RMC will be eliminated by a response action based upon the camper RMC for arsenic.

There are two types of threats: offsite and onsite. Offsite threats include historic releases that have resulted in migration of arsenic tailings into the town of Fairfield and have caused the emergency removal of yard soils in one residence by EPA. Future releases could occur from the site with major flood events and carry large amounts of arsenic-laden tailings into Fairfield. The tailings are easily eroded in flood events as verified by observation of the extreme gullying and washout of the tailings and tailings dams. A major release could also threaten the water supply for Fairfield as it is a spring that is only protected by small berms.

Onsite threats include health risk to site visitors, especially campers and ORV or ATV users. Campers are exposed to 76 times the acceptable risk to arsenic as a carcinogen, while ATV users are exposed to about 5 times the acceptable cancer risk for arsenic. In addition, these users typically carry tailings dust or mud onto their clothing, vehicles and equipment and may be exposed further to arsenic at home.

Arsenic is toxic to plants above 100 ppm. Currently, at least 50 acres are devoid of vegetation, provide no habitat and do not support life. Exposure to arsenic on the tailings is about 5-6 times the acceptable exposure using BLM's risk management criteria. In addition, the tailings affect surface water quality during precipitation events and may further expose wildlife to high concentrations of arsenic.

Actual or threatened releases of arsenic, lead and mercury from this site, if not addressed by implementing the response action selected in the Action Memorandum, may present an imminent and substantial endangerment to public health, welfare, or the environment.

## **PREVIOUS ACTIONS**

Between 1996 and 1998, BLM and the EPA conducted preliminary assessments of the tailings impoundments, downstream depositional areas, and local springs. Elevated concentrations of arsenic were found and determined to be a potential health risk to recreational users of the Site. Arsenic is toxic to plants and animals, and is a human carcinogen. During 1999, EPA also sampled residential yard soils in the town of Fairfield. During 2000, EPA conducted an emergency removal of yard soils from two residences in Fairfield.

These data have led the BLM to evaluate the need to conduct a non-time-critical removal action to address sources of hazardous substance releases within the Site.

BLM and EPA conducted a joint public meeting in the Town of Fairfield on March 14, 2000 to discuss the release of arsenic from the Site and findings of soil sampling in the Town of Fairfield. BLM

addressed its plans for the main site. In addition, BLM has consulted with Town officials and residents, including the manager for the Town water supply. BLM has issued press releases and several articles about the site have been presented in major newspapers and has complied with the community relations requirements of 40 CFR 300.415 (m). A notice was placed in the Deseret News concerning the availability of the Draft EE/CA for public comment. The only significant comments received were from the State Department of Environmental Quality. The comments and BLM's responses are part of the Administrative Record and were established at the BLM Office, 2370 South 2300 West in Salt Lake City and at Lehi Library.

## **CURRENT ACTIONS**

BLM completed the design plans and specifications using the Bureau of Reclamation's Provo office. Other ongoing activity includes funding requests and negotiations with potentially responsible parties. A construction contractor, the Opal Group, was selected and Phase I of the work will begin during 2002. Phase I consists of constructing run-on controls and removal and consolidation of the upper tailings into the repository area. Phase II, to be conducted in 2003, will consist of ongoing construction of the repository and cap. Phase III, to be conducted in 2004 will consist of removal of the lower tailings area near the railroad right of way and placement into the repository.

The Utah Department of Health was consulted on several occasions and was been sent sampling plans, preliminary assessments and the EE/CA for review and comment. The Utah County Health Department has been consulted for information on the Fairfield water supply. The State and County will be involved in construction of the remedy for the Site. The County and Utah Department of Transportation have been involved in review of design and construction aspects concerning improvements to the County road and other road access.

## **PROPOSED ACTIONS AND ESTIMATED COSTS**

The EE/CA presented a study of the nature and extent of contamination at Manning Canyon, removal action objectives and action levels, a brief risk assessment and various alternatives to remedy the health risks. The overall goal of the response alternatives evaluated in the EE/CA is to reduce the release and threat of release of arsenic, mercury, and lead from the Manning Canyon Site, thereby reducing risks to human health and the environment. The alternatives were screened based on effectiveness in reducing risk, implementability and cost. A preferred alternative of an on-site repository was selected. The EE/CA has been prepared in accordance with the criteria established under the CERCLA, and sections of the National Contingency Plan (NCP) applicable to removal actions (40 CFR 300.415 (b)(4)(i)). The EE/CA is also consistent with EPA guidance document, Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. The EE/CA removal action objectives were:

- , Reduce or eliminate the release of arsenic, lead, and mercury from the Manning Canyon mill site via surface water during flood events.

- , Reduce or eliminate the release of arsenic, lead, and mercury from the Manning Canyon mill site via surface water to ground water pathways.
- , Reduce or eliminate the release of arsenic, lead, and mercury from the Manning Canyon mill site via soil to air pathways.
- , Reduce or eliminate the release of arsenic, lead, and mercury from the Manning Canyon mill site via soil to ground water pathways.
- , Reduce or eliminate the potential for exposure to humans and wildlife from direct contact, ingestion, or inhalation with contaminated surface soils.

Conceptual designs were developed for each of the four removal alternatives, and an opinion of probable cost was prepared for each.

### **Alternative 2 - On-Site Repository and Surface Water Diversion (Selected)**

The final EE/CA Alternative 2 is the recommended alternative. This alternative involves placing the tailings from the piles and ponds into an on-site repository near the tailings deposits. This represents a minor design change from the Draft Final EE/CA which conceptualized two repositories. Additional analyses demonstrated that a single repository is less expensive and reduces operation and maintenance requirements. The repository will be sited to keep the consolidated tailings out of the 500-year flood plain. The tailings that are contained near drainage courses will be relocated to reduce the potential for these tailings to be washed downstream during flood events. In addition, the channel will be restored and sized for the 500-year flood event, and run-on controls will be established around the repository. This alternative best met the screening criteria as most effective, implementable and cost-effective. The other alternatives evaluated are described below:

### **No Action Alternative (Not Selected)**

This alternative, by definition, would involve taking no action at the site. The risks to human health and the environment at the site would remain unchanged. The cost associated with this alternative is zero, since nothing will be done to change the status or condition of the site.

### **Alternative 1 - Institutional Controls and Surface Water Diversion (Not Selected)**

Alternative 1 involved developing measures that would reduce exposure to persons and reduce the transport of tailings from the Site downstream due to flood events. The measures that were considered include restricting access to the Site by instituting deed restrictions on the lands containing waste material,

installing barriers to access, providing warning signs, and constructing diversion channels to route surface water flows away from the tailings and around the Site. The surface water flowing through the Site would be diverted to a constructed channel on the west side of the property that follows the existing drainage channel.

### **Alternative 3 - Off-Site Repositories and Drainage Channel Reconstruction (Not Selected)**

Alternative 3 involved removing the tailings from the piles and ponds, transporting the waste material off-site, and consolidating it in off-site repository areas. The repositories would be located out of drainage courses and isolated from ground water pathways. For the purposes of the EE/CA, the off-site repository area considered five abandoned clay pits that are southwest of the project site.

### **Alternative 4 - Waste Consolidation and Treatment (Not Selected)**

Alternative 4 involved consolidating the tailings on-site and treating the surface of the waste pile to reduce the potential for release of arsenic, mercury and lead from the waste material. A comparison of the estimated present value cost for the alternatives is provided in Table 1 below.

Table 1. Summary of estimated present value costs for preliminary removal action alternatives

<u>Alternative</u>	<u>Description</u>	<u>Estimated Present Value Cost (\$)</u>
0	No Action Alternative	\$0
1	Institutional Controls and Surface Water Diversion	\$3,778,000-5,002,000
2	On-site Repository and Surface Water Diversion	\$7,225,000-9,211,000
3	Off-site Repositories and Drainage Channel Reconstruction	\$13,207,000
4	Waste Treatment and Consolidation	\$14,012,000

## **CONCLUSION**

The present value cost includes initial response action capital costs, post-removal site-control costs, and long-term site maintenance and monitoring costs. These costs were estimated for a 30-year period and converted to year 2000 dollars.

ARARs are applicable or relevant and appropriate requirements contained in federal or more stringent state laws and regulations. ARARs are itemized and discussed in the EE/CA. State regulations concerning air and water quality will be attained by the selected remedy. Since the canyon is dry and groundwater is more than 100' below ground surface, no exceedance of water quality standards is anticipated provided best management practices for erosion control are complied with. Since there are no applicable state or federal soil standards, BLM risk management criteria for campers are to be considered ARARs for soil contamination. The repository will be sited in areas out of the 500 year flood plain and away from cultural or historical features, insofar as possible.

## **REFERENCES**

- BLM, 2000, Final Engineering Evaluation/Cost Analysis, Manning Canyon Tailings. National Science and Technology Center, Denver, CO.
- Ford, 1996, Risk Management Criteria for Metals at BLM Mining Sites, Technical Note 390, National Science and Technology Center, Denver, CO.